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ABSTRACT

Various areas of research related to inhalants are summarized and general guidance in dealing with this complex and urgent problem is provided. Topics include (1) "Characteristics of Inhalants," which reviews chemicals found in inhalants and common modes of administration; (2) "Defining Inhalant Use and Abuse," which includes epidemiology, drug effects, and chemical categories; (3) "Trends in Inhalant Prevalence," which addresses Texas school students; (4) "Classifying the Inhalant User and Abuser," which explains user-based categories and user-pattern categories; (5) "Causes and Consequences of Inhalant Use," which reviews correlates and cues to inhalant use; (6) "Effects of Inhalant Use," which covers general, acute, and chronic effects and needed research; (7) "Treatment of Inhalant Users," which reviews problems in outreach, screening, diagnosis, detoxification, life skills, peers, and family treatment; (8) "Prevention of Inhalant Use," which reviews a number of problems to be overcome in planning prevention efforts; (9) "Research Issues in Inhalant Use," which presents issues specific to inhalant use; and (10) "Summary of Inhalant Issues." Brief, relevant articles are presented in boxes in various chapters. Appendix A provides a table of "Characteristics of Inhalant Users" with corresponding research references. (Contains 175 references.) (EMK)

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Understanding Inhalant Users

Texas Commission on Alcohol and Drug Abuse

Revised 1997

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UNDERSTANDING INHALANT USERS

An Overview for Parents, Educators, and Clinicians

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This report was updated in 1996/97 by Fred Beauvais, Ph.D., Jane Maxwell, M.A., and Liang Liu, Ph.D.

PREFACE

Every year, scores of Texas children, most of them not yet even in their teens, begin a destructive journey to addiction by inhaling correction fluid, solvents, paint, and a variety of other products. In 1988, the Texas School Survey revealed an alarming rate of inhalant use. The 1990, 1992, 1994 and 1996 School Surveys revealed lower but still unacceptably high rates of use, even among children as young as the fourth grade. Early inhalant use is clearly an indicator of high risk for multiple problems with school and other drugs. Counselors and agencies that work with youngsters at risk for inhalant abuse have taken up the challenge to help these children be all they can be, and prevent them from acquiring the permanent disabilities that can result from using inhalants.

A continuing problem in the prevention and treatment of inhalant problems is the scarcity of research findings to guide these efforts. The purpose of this report is to summarize and interpret what is known from the various areas of research related to inhalants and to provide general guidance in dealing with this complex and urgent problem.

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INHALANT USERS

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CHARACTERISTICS OF INHALANTS

Most abused solvents are central nervous system depressants, which can lead to unconsciousness and death at high concentrations and prolonged exposure. At low concentrations and short durations of exposure the user often exhibits excitation before the depressant effects (Pryor 1990). In many ways inhalant symptoms resemble those of alcohol and barbiturate intoxication, with a comparatively quicker onset (within five minutes) and a shorter duration after use. Although many solvents are depressants, they have extremely different pharmacologic and neurotoxicologic characteristics. The effects of a solvent mixture cannot be predicted simply from the pharmacology of its components or vice versa (Pryor 1990). Prolonged exposure to inhalant and volatile solvents produces toxic effects such as: (a) acute encephalopathy (brain disease); (b)cerebellar ataxia (staggering gait); and (c) peripheral neuropathy (visual and hearing impairments). A few case reports suggest effects on newborns. Chronic use of inhalants may lead to psychological dependence, or occasionally, physical dependence (WHO 1986). "Sudden sniffing death" can occur with one time use due to asphyxia or heart malfunciton.

Most volatile solvents have a high affinity for lipids (fats), hence their high distribution to organs rich in lipids (e.g., brain, liver, and adrenal). These fat-soluble products are eliminated through the kidneys after several biochemical breakdown reactions that render them more water soluble (Rosenberg 1990). As a result of these reactions, additional compounds are produced, and some are more neurotoxic than the parent chemical (Goetz 1985; O'Donoghue 1985; Spencer & Schaumburg 1980; Allen 1979, Sharp & Rosenberg, in press).

Identifying the exact solvent or solvents responsible for observed effects has been very difficult because of the following conditions: (1) the commercial and industrial products used are typically mixtures; (2) the formulations and choices of the mixtures change over time; and (3) the subjects involved are often influenced by a variety of factors (e.g., use of other drugs) that might be responsible for any observed disorder (Pryor 1990).

CHEMICALS FOUND IN INHALANTS

There are hundreds of available household and commercial products which can be inhaled. Generally speaking the abused inhalants include volatile solvents (e.g., gasoline, glue, paint, polishes), anesthetics, nitrites, and aerosols. In addition, there are many chemical substances found in these commercial products which are responsible for the inhalation effects. Following is a list of some of the most common: (1) aliphatic hydrocarbons; (2) aromatic hydrocarbons (e.g., toluene); (3)halogenated hydrocarbons; (4) fluorocarbons; (5) aliphatic nitrites; (6) ketones; (7) esters; (8) alcohols; (9) glycols; (10) ethers; and (11) nitrous oxide gas. The following sidebar depicts the primary chemicals present in many inhalants.

CHEMICALS COMMONLY FOUND IN INHALANTS

ADHESIVES

Airplane Glue	toluene; ethyl acetate
Rubber Cement	hexane; toluene; methyl chloride; acetone; methyl ethyl ketone; methyl butyl ketone
PVC Cement	trichloroethylene

AEROSOLS

Paint Sprays	butane; propane (U.S.); fluorocarbons; hydrocarbons; toluene
Hair Sprays	butane; propane (U.S.); fluorocarbons
Deodorants, Air Fresheners	butane; propane (U.S.); fluorocarbons
Analgesic Spray	fluorocarbons
Asthma Spray	fluorocarbons

ANESTHETICS

Gaseous	nitrous oxide
Liquid	halothane; enflurane
Local	ethyl chloride

CLEANING AGENTS

Dry Cleaning	tetrachloroethylene; trichloroethane
Spot Removers	tetrachloroethylene; trichloroethane; trichloroethylene
Degreasers	tetrachloroethylene; trichloroethane; trichloroethylene

SOLVENTS & GASES

Polish Remover	acetone
Paint Remover	toluene; methylene chloride; methanol
Paint Thinners	toluene; methylene chloride; methanol
Correction Fluid Thinners	trichloroethylene; trichloroethane
Fuel Gas	butane
Lighter	butane; isopropane
Fire Extinguisher	bromochlorodifluoromethane

FOOD PRODUCTS

Whipped Cream	nitrous oxide
Whippets	nitrous oxide

"ROOM ODORIZERS"

(Locker Room; Rush; Poppers)	(iso)amyl nitrite; (iso)butyl nitrite; (iso) propyl nitrite; butyl nitrite

— Charles Sharp, Ph.D. and Neil Rosenberg, M.D.

COMMON MODES OF ADMINISTRATION

In general, inhalation is by nose or mouth (bagging or huffing), or sometimes absorbed through the skin or stomach. More specifically, modes of administration entail:

1. sniffing/inhaling directly from containers
2. sniffing/inhaling substances sprayed inside of paper or plastic bag
3. sniffing/inhaling substances sprayed inside cola cans
4. sniffing/inhaling from cloth/clothing saturated with the substance
5. aerosol inhalation (directly spraying into nose or mouth)
6. inhaling from alternative containers (e.g., balloon filled with nitrous oxide)
7. inhalation of vapors emitted by heating volatile substances

FETAL EFFECTS OF INHALANT USE

The effects of inhalant abuse upon the unborn child are unknown. Since chronic abuse produces functional and structural damage in the mature individual, it is reasonable to expect that the developing fetus would be at particular risk. Dysmorphic features, as well as physical and neurologic impairments, have been reported, although conclusive evidence for a fetal solvent syndrome is not available (Hersh et al. 1985; Hersh 1989; Hunter et al. 1979). Anecdotal published personal observations include acute neonatal withdrawal, transient neonatal renal tubular acidosis, intrauterine growth retardation, developmental delay, and impairments of vision and hearing. Much more information is needed to characterize the consequences of solvent abuse during pregnancy in order to devise effective strategies for dealing with this problem.

— Milton Tenenbein, M.D.

DEFINING INHALANT USE AND ABUSE

The term "inhalants," as commonly used in the drug abuse field, has become overly generalized. There are hundreds of commercial and household products which can be inhaled, and thus have some drug abuse potential. While the generality of the term "inhalants" is appealing in its simplicity, it also has caused confusion.

Currently the terms "inhalants" and "inhalant users" are commonly defined by the method of using the substances rather than by their chemical action (Beauvais, 1990; Beauvais & Oetting, 1987). However, different classes of inhalants have their own specific effect, and are used by different types of individuals. Lumping all inhalable substances and all inhalant users together interferes with prevention, diagnosis and treatment efforts. Due to the wide range and complexity of the number of inhalable substances available, a precise categorization is difficult; the following is one attempt to bring some order to the types of chemicals that are inhaled.

EPIDEMIOLOGY OF USE

Survey and ethnographic data can yield valuable information about the trends in use and what substances are currently being used, or what substances are in vogue in certain locales.

Volatile Solvents & Gas Products. These include glue, model airplane cement, rubber cement, pvc cement, lighter fluid, fuel gas, fire extinguisher compounds, paint thinner, paint remover, lacquer, lacquer thinner, degreasing compounds, carburetor cleaners, typing correction fluid, gasoline, gasoline additives, dry cleaning fluid, spot removers, fingernail polish remover, liquid shoepolish, wax strippers, plus many other household and commercial products. Glue sniffers typically use a form of plastic cement. Toluene, a prime constituent of most glues and plastic cement, can also be found in some non-leaded gasolines.

Aerosols. Non-stick cooking sprays were among the first aerosols discovered by sniffers. Other aerosols are now used as well, including hair sprays, deodorants, analgesic and asthma sprays, air fresheners, fabric guard, spray paints (especially bronze, silver and gold paints), and clear spray lacquers. Freon, whether obtained from spray cans, air conditioner units or mechanical supplies, is also inhaled.

Anesthetics. The most common anesthetics are ether, chloroform, and nitrous oxide. In cold climates, ether is readily available in "quick engine starter" products. Nitrous oxide (laughing gas) is an anesthetic but is also used as a propellant for whipping cream and as an octane booster for race cars. Of historical note is the ether drinking epidemic in Ireland of the 1890s, presumably a result of the then newly-imposed and excessively high taxes on distilled spirits.

ARRIVING AT A STANDARD DEFINITION OF INHALANTS

There have been several attempts to establish a convention regarding the nature of what constitutes "inhalants." Beauvais and Oetting (1987) have argued that the term "inhalant abuse" should be restricted to the use of volatile solvents and should exclude the use of the nitrites and anesthetic gases. This is based on differences in both the neurochemical actions and on the clinical profiles of the users of these three classes of substances. This convention was also followed in the DSM-IV where the diagnoses "inhalant abuse" and "inhalant induced organic mental disorder" are restricted to the use of volatile solvents. Nitrite and anesthetic gas abuse are diagnosed separately.

The most consistent attempt to arrive at a common label has been in the journal *Human Toxicology*. The entire July, 1989, issue is devoted to various aspects of the abuse of volatile solvents and throughout the issue the term "volatile solvent abuse" (VSA) is used to denote the behavior. This not only provides a common terminology but also restricts the issue to solvents and excludes other psychoactive substances that are inhaled, in particular the nitrites and anesthetic gases. This approach seems very reasonable as long as the label is used carefully and is not applied indiscriminately to all levels of solvent use. It is very common for many young people to have a single episode, or a short period, of inhaling substances and it would be inappropriate to refer to these as "abuse." Perhaps another convention, "volatile solvent use," would be appropriate for these less severe patterns.

— *Fred Beauvais, Ph.D.*

Volatile Nitrites. These primarily include (iso)amyl nitrite and (iso)butyl nitrite. Unlike many other inhalants which are taken primarily for their perceived euphoric and intoxicant effects, the nitrites seem to be used recreationally to enhance sexual pleasure and/or performance. Amyl nitrite, a vaso-dilator, was originally used medically for the treatment of angina. Unlike other inhalants, it passed down to adolescents from older drug users who believed it lengthened and heightened orgasm, enhanced sexual performance, delayed premature ejaculation, or disinhibited sexual performance. Use has been documented particularly among women (Farabee, 1994). Once demand was established, underground enterprise began to supply an over-the-counter version, namely butyl nitrite, sold under many trade names. Some are euphemistically marketed as "room odorizers," while others are openly marketed in bars and clubs as "poppers."

Powdered Stimulants and Depressants. Other powdered drugs including cocaine, methamphetamine, and heroin are inhaled. However, these are not considered "inhalants" for purposes of this report.

While these categories bring together similar types of chemicals, they do not necessarily correspond to the different types of users. Beauvais and Oetting (1987), for instance, have suggested that the term "inhalant user" be limited to those who use volatile solvents, gases and aerosols. This by far includes the majority of youth and adults who use substances. Sharp and Rosenberg (in press) would expand this category somewhat and include those who also use some forms of nitrous oxide. This is

based on an emerging pattern where nitrous oxide is becoming commercially available in large tanks; thus it has become available outside of the medical field and is used by those who are also using volatile solvents and aerosols. Likewise, freon is abused by air conditioner technicians. Defined in this way, it is possible to describe a group of people who are fairly similar on a number of psychological and social dimensions as shown in the next section. In contrast, there are other groups who inhale primarily anesthetics or the volatile nitrites but who are entirely different from the typical "inhalant" user. One example of this would be medical professionals who become addicted to certain types of anesthetics.

OBSERVED VS. PERCEIVED DRUG EFFECTS

Inhalant use classifications can be based on the observed physical and psychological effects of the substance on the user. While it is important to note such pharmacological effects, they must be understood within the context of how the user perceives those effects. Thus, another approach is to classify effects which the user experiences or perceives experiencing, i.e., phenomenological effects. It is clear that not all users perceive (or report) the same effects from the same substance (Becker 1980), so "user categories" would not necessarily match pharmacological or toxicological ones. However, the user's reasons for use may be the major key to developing a classificatory system (Sharp 1990). There are two aspects to user phenomenology: what the user experiences when the drug is taken (what the user thinks or feels, or how the pharmacological effect is interpreted) and what is verbalized as the motive for taking the drug. An examination of perceived effects may explain why some people continue and increase use of a particular substance while others do not. Some users, for example, say they prefer inhalants because they can carefully control the "high." When they begin to "come down" or lose the effect, they simply have to take another sniff or two to achieve the feeling they prefer. Other drugs cannot be modulated this finely. Neither treatment nor prevention of inhalant abuse can progress without recognition of user phenomenology. For this system to be effective, however, researchers must be aware of a number of sources of bias that affect scientific conduct, such as the experimenters themselves, the research settings, unique characteristics of the clients under study, matters of cultural relevance and sensitivity of the test instruments.

TRENDS IN INHALANT PREVALENCE

Survey and ethnographic data can yield valuable information about the trends in use and what substances are currently being used, or what substances are in vogue in certain locales. Knowledge of the demographic and social characteristics of surveyed individuals who have problems can also help inform the development of appropriate outreach strategies and specific components of prevention and treatment programs. The survey-based estimates of substance abuse and dependence are useful in needs assessment and resource allocation, especially on a regional and local basis.

The biennial survey of substance use among Texas secondary students shows that a significant proportion of Texas youths use inhalants and that inhalant use remains problematic, particularly for students in seventh and eighth grades and for those who experience academic, attendance, and disciplinary problems in school (Liu, in press). In the 1996 Texas survey, about 20 percent of students in grades seven through twelve admitted lifetime use of inhalants and 5 percent reported past-month inhalant use. Data from the National Household Survey on Drug Abuse shows that in 1994, 7 percent of 12-17 year olds reported use of inhalants at least once in their lifetime, and 2 percent reported using inhalants in the past month.

Inhalant use exhibits a peculiar age pattern not observed with any other substance. While among secondary students use of tobacco, alcohol, marijuana, and other illicit drugs peak in late adolescence at 17-18 years of age, inhalant use is most prevalent among younger students

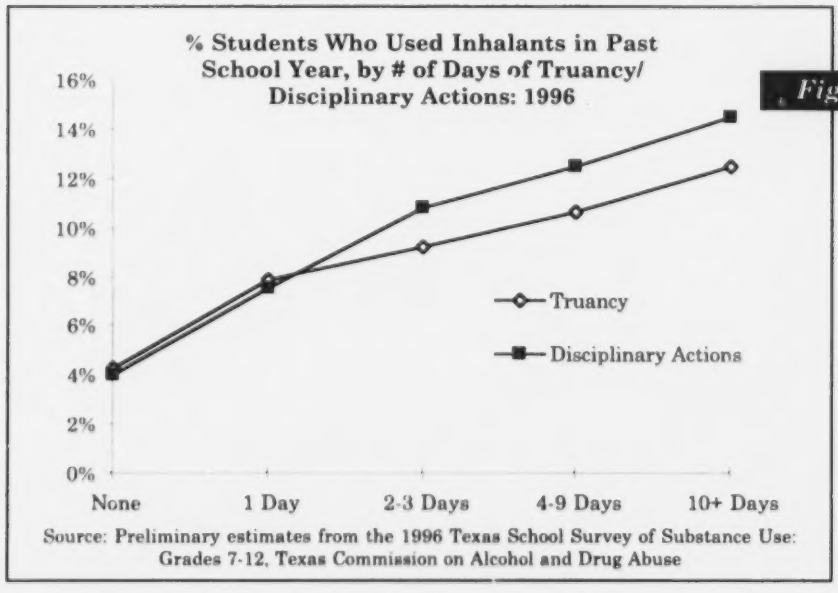
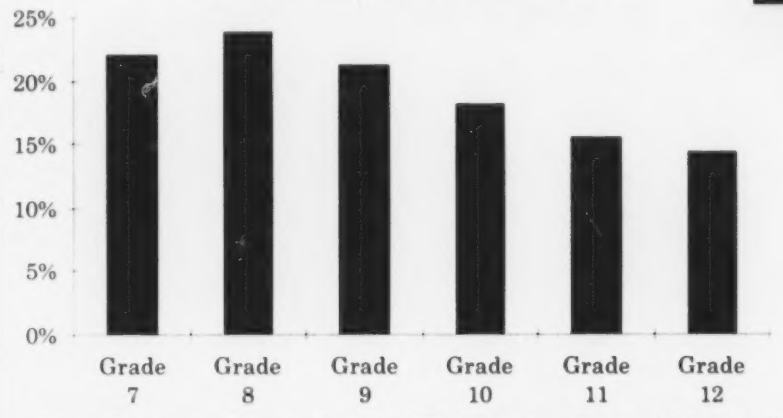


Figure 1

Source: Preliminary estimates from the 1996 Texas School Survey of Substance Use: Grades 7-12, Texas Commission on Alcohol and Drug Abuse

Lifetime Inhalant Use
Texas School Students Grades 7-12

Figure 2



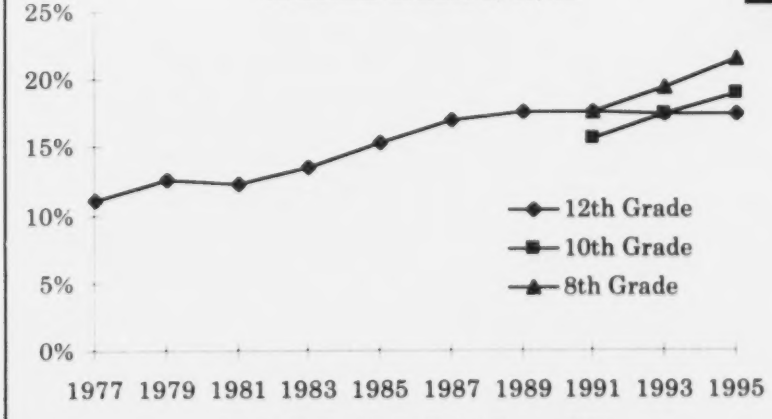
Source: Preliminary Estimates from the 1996 Texas School Survey of Substance Use: Grades 7-12, Texas Commission on Alcohol and Drug Abuse

at 13-14 years of age. Inhalants are generally seen as a "kid's drug" and the use declines as adolescents shift to the use of other drugs such as alcohol and marijuana. Early use is due in part because inhalants are readily available and inexpensive. Another partial explanation for this pattern is that many young people who use inhalants usually experience a host of other problems, including, truancy (Figure 1), poor school adjustment, and dropping out (Oetting & Webb 1992). These youthful inhalant users are simply not in school in later grades to respond to school-based surveys.

The Texas school survey shows the pattern of early peaking in inhalant use. For example, 22 percent of seventh graders and 24 percent of eighth graders in 1996 reported lifetime inhalant use, whereas 14-16 percent of eleventh and twelfth graders reported lifetime inhalant use (Figure 2). In fact, seventh graders were more likely to have experimented with inhalants than with

Lifetime Inhalant Use
National High School
Students Grades 8, 10, 12

Figure 3



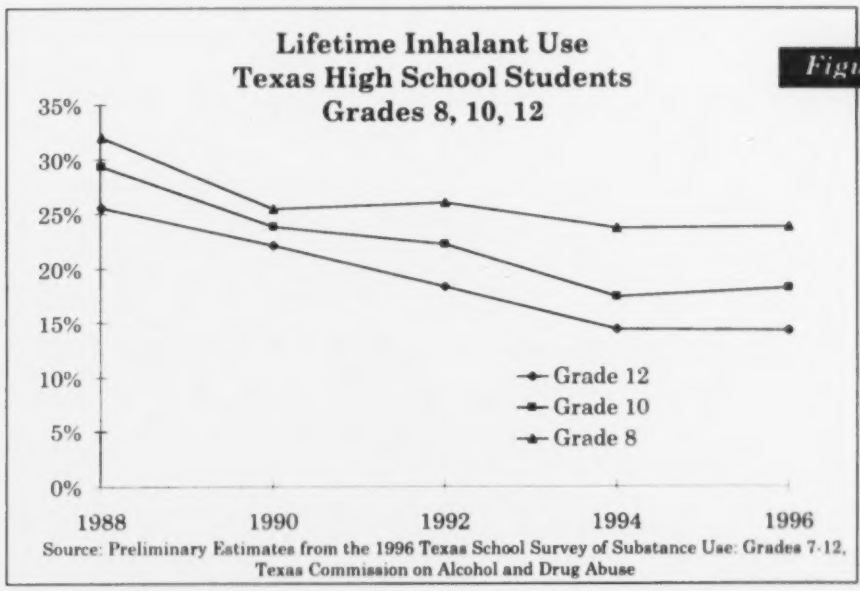
Source: Monitoring the Future Survey, NIDA

any of the illicit drugs, including marijuana. As with lifetime prevalence, past-month prevalence was highest among younger students. Texas seventh graders (8 percent) were about four times more likely than twelfth graders (2 percent) to admit past-month use of inhalants. By contrast, Texas seniors in the 1996 survey were twice as likely as seventh graders to report past-month use of alcohol (51 percent of seniors vs. 23 percent of seventh graders) or an illicit drug (21 percent of seniors vs. 10 percent of seventh graders).

The pattern of inhalant use decreasing with age also holds for national data (Figure 3). The Monitoring the Future Study began its annual survey of high school seniors in 1975, and was expanded in 1991 to include eighth and tenth graders. The 1995 survey found about 21 percent of eighth graders, 19 percent of tenth graders, and 17 percent of twelfth graders said they had sniffed inhalants—usually volatile solvents—at least once in their lives; 6 percent of eighth graders and 3 percent of tenth andtwelfth graders reported using inhalants in the previous month prior to the survey (NIDA 1996). Among eighth graders in this national survey, the level of use of inhalants is much higher than that of most drugs and is exceeded only by the level of use of marijuana, alcohol, and cigarettes.

Lifetime inhalant use among national seniors increased substantially between 1976 and 1990, then dropped slightly between 1990 and 1996. On the other hand, the percentage of eighth or tenth graders in the nation who had ever used inhalants showed an increasing trend from 1991 to 1996. The trend toward increasing use of inhalants among eighth and tenth graders nationwide was in contrast to the trend for their counterparts in Texas during 1988-1996. The Texas surveys (Figure 4) have shown substantial reductions in lifetime use of inhalants among eighth graders (from 32 percent in 1988 to 24 percent in 1996) and tenth graders (from 29 percent in 1988 to 18 percent in 1996).

Gender-related differences in the prevalence of inhalant use tend to be slight. In 1996, for example, Texas male students (21 percent) were slightly more likely than female students (19 percent) to admit lifetime exposure (Table 1). However, differences in ethnic reporting patterns were persistent over time. In 1996, African-American students



Source: Preliminary Estimates from the 1996 Texas School Survey of Substance Use: Grades 7-12, Texas Commission on Alcohol and Drug Abuse

(11 percent) in Texas reported lower rates of lifetime inhalant use than Anglos (21 percent) or Hispanics (23 percent). A similar ethnic distribution was also found in the national Monitoring the Future study (1995) which reported the following lifetime prevalence rates for U.S. high school seniors: African Americans, 6.5 percent; Hispanic, 15.2 percent; and Anglo, 20.1 percent.

Most youths who experiment with inhalants tend to use specific products only a few times. The Texas school survey instrument asked about use of ten commonly abused inhalants, including liquid or spray paint, whiteout, gasoline, freon, poppers (such as Locker Room), shoe shine, glue, thinners or solvents, other sprays, and other inhalants. From 1988 to 1996, correction fluid was the most popular volatile solvent abused by Texas youths. For example, 9 percent of secondary students admitted using correction fluid to get high at least once in the 1996 Texas school survey. However, only one out of four of these lifetime correction fluid users (2.5 percent of secondary students) reported abusing correction fluid three or more times. The "times used" distribution is consistent for all other inhalant products. A majority (67 percent) of Texas secondary students reporting lifetime use of liquid or spray paint, for example, had used only once or twice, and only one-third of the users had done so three or more times in their lives.

While youthful inhalant users tend to use specific products only a few times, they experiment with several different types of inhalants. In 1996, more than 60 percent of lifetime inhalant youths in Texas admitted using two or more products from the list of specific inhalants queried. And, younger students used more types of inhalants than older students. About 14 percent of seventh graders and 15 percent of eighth graders in the 1996 Texas survey had ever used two or more different types of inhalants, whereas only 7-8 percent of juniors and seniors had

Table 1

Percentage of Texas Secondary Students Who Have Ever Used Inhalants by Demographic Categories: 1992, 1994, and 1996

	1992	*1994*	*1996*
Total Students	23.2%	18.7%	19.8%
Sex			
Male	23.4%	20.3%	20.5%
Female	22.9%	17.2%	19.2%
Race/Ethnicity			
White	24.2%	19.1%	20.8%
African American	15.5%	11.4%	11.3%
Hispanic	26.4%	22.2%	22.5%
Usual School Grades			
A's and B's	19.9%	15.8%	17.1%
C's or lower	30.9%	26.7%	28.7%
Family Structure			
Live with Both Parents	22.5%	17.3%	18.3%
Other Family Structures	24.3%	21.0%	22.3%

Source: Preliminary Estimates from the 1996 Texas School Survey of Substance Use: Grades 7-12, Texas Commissionon Alcohol and Drug Abuse

done so. Moreover, those younger users who admitted using multiple inhalant products tend to report use of several volatile solvents, but not nitrites (Liu in press).

Unlike other inhalants, the nitrites are more likely to be used by older students. In other words, youths who begin using inhalants in later adolescence appear to use nitrites, and tend not to have had previous experience with volatile solvents. The 1996 Texas school survey shows that about 2 percent of seventh graders reported lifetime use of "Poppers, Locker Room, or Rush" (the amyl or butyl nitrites), compared to 5 percent of seniors. Poppers were most popular among males and Anglo students; lifetime use for each of these groups reached 8 percent in grade twelve.

Although inhalant use is commonly seen as an adolescent phenomena, some use extends into adulthood. In Texas, the 1996 Adult Survey reported a lifetime inhalant use of 8 percent for adults aged 18-24, 6 percent for adults aged 25-34, and 3 percent for those aged 35 and over (Wallisch, in press). The past-month use of inhalants in these adult groups was quite low at 0.5 percent or less. Male adults (6percent) aged 18 and over had a higher rate in lifetime use than females (2 percent). Similar to the ethnic distribution among youths, African-American adults reported a lower lifetime prevalence of inhalants (2 percent) than both Anglo and Hispanic adults (5percent). In the nation, the 1994 National Household Survey showed that lifetime use of inhalants was 10 percent for adults aged 18-25, 11 percent for adults aged 26-34, and 3percent for adults aged 25 and over nationwide (SAMHSA 1995). And the past-month prevalence of inhalant use among these adult groups nationally was 0.8 percent or less.

CLASSIFYING THE INHALANT USER & ABUSER

Inhalant users can be classified by using a scheme that combines epidemiological, psychological, sociological and ethnographic data. For example, nitrites are often used for sexual purposes by people who otherwise are sociodemographically unlike other inhalant users, whereas nitrous oxide and other anesthetics are used by certain medical personnel (Perez de Francisco 1975) and freon is abused by air conditioning technicians and engineering technicians (Maxwell 1994). A vast number of inhalant user characteristics are identified in Appendix A. Although sociodemographic features are essential in the study of inhalant abusers, widely accepted classifications have not yet been developed.

Concurrent or sequential use of multiple drugs is common among drug abuse (Wesson & Smith 1979), such as an illicit drug plus alcohol, heroin plus cocaine, and marijuana plus other illicit drugs and alcohol. Multiple use is also common among inhalant users (WHO 1986; Smart 1983; Swerhun & Le Breton 1983; Stybel et al. 1976). Some years ago, a useful distinction was made between polydrug users and multidrug users. *Polydrug user* refers to someone who uses several drugs, usually in some consecutive order, but uses only one drug at a time. In contrast, the *multidrug user* refers to someone who ingests several different drugs at one time, seeking perhaps some special interactive drug effects, or praise from peers for being daring.

CATEGORY SCHEMES

Many criteria for categorizing inhalant abusers exist. Kerner (1988) focuses on four key elements: (1) the user, (2) the substance used, (3) the context of use, and (4) the culture of use. Others have included (1) the age of the user, (2) the type of inhalant used, (3) the purpose of use, (4) descriptions of the use of inhalants in particular settings, and (5) concurrent use of other substances. In the general drug abuse literature, the work of Spotts and Shontz (1982; 1980) shows a strong link between certain personality types and use of a particular drug (e.g., stimulant vs. depressant).

Drug user categories based on the frequency of use (and implicitly, quantity), although problematic, are common because such data is relatively easy to collect. Difficulties arise because of variations in drug use levels over time, and measures of quantity and frequency of use are often aggregated. Moreover, no established criteria distinguish use from abuse.

USER-BASED CATEGORIES

Several user-based inhalant categories have been proposed. For example, Oetting et al. (1988) categorized inhalant abusers into three main types: (1) young inhalant users, (2) polydrug users and (3) inhalant dependent adults. Young inhalant users (usually up to ages 13 or 14) are typically more than once or twice experimenters. They may also use alcohol and marijuana occasionally. While their inhalant use may not be heavy, it does extend over a period of weeks or months with periodic use during that time. Polydrug users are older adolescents (about 14-18) who are using a variety of drugs but who still continue to use inhalants regularly. As use

and age progress, the pattern may become more solitary with much of their lives revolving around obtaining inhalants and seeking opportunities to use them. Inhalant dependent adults are long-term drug and alcohol users for whom inhalants appear to be the drug of choice. This can be somewhat deceptive, however. Many of these people would prefer alcohol but their marginalized way of life makes alcohol unaffordable. Nearly continuous use is sometimes observed in this group (Fredlund, 1994).

USER-PATTERN CATEGORIES

While frequency and quantity are necessary elements for any classificatory scheme, they are by themselves insufficient; other social psychological elements are often needed and included. One noteworthy scheme (Siegel 1984) proposes five use categories: (1) experimental, (2) recreational, (3)circumstantial, (4) intensified, and (5) compulsive. Experimental use refers to youth who merely experiment with drugs that are available and condoned within their peer culture. Recreational use is defined by the user's self-control of consumption. Circumstantial use refers to users who take drugs only under certain conditions, or in particular settings. Intensified use involves a regular pattern of use, even daily use, but in amounts that do not impair functioning. Compulsive use entails typically high-intensity and high-frequency use over long periods of time, and typically produces some psychological and/or physical dependency.

Central to these categories is the notion of binge or episodic use versus continuous use. It appears that many inhalant users, like cocaine users, inhale large amounts of the substance in irregularly-spaced episodes or binges, rather than in regular, continuous or habitual fashion (the latter pattern is quite typical of heroin users). The style, duration, pattern, and quantity of use are important considerations in the development of future classifications.

CAUSES AND CONSEQUENCES OF INHALANT USE

The question of what is a cause and what is an effect is a major problem when looking at substance use behavior–and it becomes more of a problem with inhalant use. A couple of examples will illustrate this. Inhalant users are known to have poor academic performance (Liu & Maxwell 1995; Frank et al. 1988). Does this poor performance lead to frustration, problems in school and then the use of inhalants? Or, does inhalant use interfere with cognitive functioning and thus poor school performance? Another major question has to do with neurological damage. It is commonly held that inhalant users incur such damage. However, there are few, if any, studies which address the question of whether some, or all, of this damage may have occurred prior to the use of inhalants. It is possible that neurologic damage prior to the use of inhalants may lead to adjustment problems within the family, or at school, thus priming the individual for future inhalant use.

While the search for specific, temporal "cause and effect" relationships may be useful at some point, it may be better to consider the characteristics of inhalant users as interactive. For example, a child from a dysfunctional family may be prone to inhalant use, but it also is likely that the use of inhalants only increases that family dysfunction. Resolution of the problem involves addressing both the family issues and the inhalant use. Appendix A lists the various interactive causes, correlates and consequences of inhalant use that have been identified.

ORIGINS OF SUBSTANCE USE

Introduction. These are the eight prime factors behind substance abuse (Lettieri 1989): (1)personality deficiency; (2)disruptive environment; (3)adaptive difficulties; (4)peer pressure; (5)stages of use; (6)self-rejecting, self-derogating attitudes; (7) ego deficits and impaired coping strategies; and (8)stress and tension reduction.

There are several conditions that increase susceptibility to inhalant abuse (Oetting et al. 1988): age; gender; ethnicity; community factors; family features; deviance; school adjustment; social adjustment; education problems; emotional problems; and, most importantly, peer influence. Although many factors can affect youth susceptibility to inhalant use, researchers stress that the peer group is almost always one of them. Best friends or fellow gang members form a drug-using peer cluster in which they share their beliefs and ideas, support the rationale for drug use, and decide who will use, how much, and when. There may also be a cultural model for the use of drugs which are inhaled (Dworkin & Stephens 1980; Trotter et al. in press); for example, the well-knit bonds in inhalant-using Mexican and Brazilian street children may be due more to cultural rather than peer factors.

The occurrence of learning disorders are disproportionately high among inhalant-abusing youth (Barratt 1990). The relatively low verbal IQ's of inhalant-using youth can be worsened by families that are typically unstable or unavailable to help children learn to overcome their

reading and talking difficulties (Barratt 1990). As a result, these youth do not adjust well to school, are more deviant, and thus are more likely to drop out and use inhalants.

Family. One of the more frequent research findings is that inhalant users suffer from serious family dysfunction. They are more likely to come from broken homes, from families with alcohol and/or drug problems, and from families that are marked by conflict and discord. Nearly every study that evaluated family structure found that inhalant users were more likely to come from homes where the primary family was not intact (Albaugh & Albaugh 1979; Berriel-Gonzalez et al. 1978; Carlini-Cotrim & Carlini 1988; Crites & Schuckit 1979; Guitierrez et al. 1978; Jacobs & Ghodse 1988; Leal et al. 1978; Massengale et al. 1963; Nurcombe et al. 1970; Schottstaedt & Bjork 1977; Zur & Yule 1990). In the few reports where there were no differences in intact family structure between inhalant users and others, the users were relatively young and both users and non-users were from groups with serious socioeconomic problems.

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Family problems also show up in other ways. A number of studies indicate that families of inhalant users may be marked by discord, aggression and/or hostility (Berriel-Gonzalez et al. 1978; Comstock 1978; Crites & Schuckit 1979; DeBarona & Simpson 1984; Gilbert 1983; Korman et al. 1980; Matthews & Korman 1981; Fredlund 1994). When family drug or alcohol use was assessed, the families of inhalant users were more likely to be substance-involved (Albaugh & Albaugh 1979; Bachrach & Sandler 1985; Berriel-Gonzales et al. 1978; Carlini-Cotrim & Carlini 1988; Crites & Schuckit 1979; Guitierrez et al. 1978; Smart et al. 1972; Smith, Joe & Simpson 1991; Stybel et al. 1976). Inhalant users with drug-using families had used more types of drugs, perceived their friends as having a more favorable attitude toward drug use, had experienced more poverty, and were more likely to have disrupted families as well as parents who had been arrested (Bachrach and Sandler 1985).

Opportunity. Although inhalant users almost uniformly experience family problems such as alcoholism, drug use, and broken families, all of which should negatively influence socioeconomic status (SES), studies do not show large and consistent differences in SES. The lack of consistent findings in this area may be because measures of SES tend to be somewhat unreliable. It is more likely, however, that the difficulty lies in study comparisons: really low SES groups may be underrepresented in population surveys or in school-based surveys, and therefore these studies may miss the groups lowest in SES and, possibly, highest in inhalant use. Inhalant users themselves often show problems with employment (Berriel-Gonzalez et al. 1978; Comstock 1978; Korman et al. 1980; Fredlund 1994).

School. Inhalant users also have serious problems in school. Inhalant users seem to disappear from school-based surveys beginning with the eighth grade (Beauvais 1990). Research results indicate that these students drop out. When compared with either non-users or with users of other drugs, inhalant users tend to have greater difficulty in school. They are more likely to have high

INHALANT USE CORRELATES

In several ways the research on inhalant use is remarkable. First, early research, prior to 1975, and research completed since then are essentially consistent and lead to the same conclusions about inhalant users. Considering that drug use has changed radically over this time span, differences in findings over time might be expected. Instead, the recent research has only expanded on and amplified earlier conclusions. Second, the research is remarkably consistent; within a psychosocial area, the studies show high agreement. Third, the research results lead to similar conclusions regardless of age of the study population: inhalant users are found among the subjects who have the fewest social resources at any age and in any group. Fourth, results are consistent across cultures. Research results from four continents and, within the United States, from a number of different cultural contexts, are fundamentally in agreement.

The most general conclusion is that inhalant users are likely to be marginal in society. Inhalant use is highest in areas of poverty, prejudice, lack of opportunity, and dysfunctional family environment. Youth who are failing in school, showing lack of ability to meet the requirements of that environment, are also among those most susceptible to inhalant use. Inhalant users have friends who are also marginal; they are likely to be involved with inhalants, since most inhalant use is a group activity. Those who do move on to solitary use, however, are probably the ones with the most problems. With all these social problems, it is not surprising to find that inhalant users are also likely to have problems with school authorities, to be involved in criminal behaviors, and to suffer from emotional distress.

— *E. R. Oetting, Ph.D.*

absenteeism, to have been suspended, to drop out or have been expelled, and to have poor academic performance and lower grades (Altenkirch & Kindermann 1986; Bachrach & Sandler 1985; Beauvais et al. 1996; Carlini-Cotrim & Carlini 1988; Coulehan et al. 1983; Jacobs & Ghodse 1988; Matthews & Korman 1981; Reed & May 1984; Carlini-Cotrim & Carlini 1988; Coulehan et al. 1983; De Barona & Simpson 1984; Korman et al. 1980; Liu & Maxwell 1995; Matthews & Korman 1981; Wingert & Fifield 1985).

Deviance and Delinquency. As might be expected, since inhalant users have trouble adjusting to work and to school, they also have trouble adjusting to society in general. Even among other drug users, inhalant users stand out as deviant.

Inhalant users seem to be more likely to be involved with other drugs. Although there are those who prefer inhalants, the studies that have looked at a range of drug use often find that inhalant users are heavily involved with other drugs as well (Jacobs & Ghodse 1988; Mata & Andrew 1988; Carlini-Cotrim & Carlini 1988; Compton et al. 1994; Dinwiddie et al. 1987; DeBarona & Simpson 1984; Ellison 1964; Shurtz et al. 1994; Sokol & Robinson 1963). This heavier involvement with drugs in general may help to explain some other findings. Among the inhalant users in a Texas youth program, chronic sniffers had been arrested an average of 9 times, 40 times more often than non-drug users, and twice as often as occasional sniffers (Stybel et al. 1976). In a study of Hispanic youth, two-thirds of the inhalant users who were patients in a treatment program had been arrested compared with only 3 percent of a control group (Berriel-Gonzalez et al. 1978). Among Hispanic youth in Texas drug prevention programs, inhalant users were more likely to have been stopped and questioned by the police, to have been arrested, and to be on probation (DeBarona & Simpson 1984).

Inhalant users are also likely to get into trouble with the law earlier than users of other drugs. Among adolescent delinquents in London, on the average, the first arrest of inhalant users occurred about a year and a half before the first arrest of users of other drugs (Jacobs & Ghodse 1988). Inhalant using delinquents from a city in the southwestern United States, when compared with other delinquents, had been arrested almost 3 times as often, were arrested more often for the more serious crimes, and the age of first arrest was lower (Reed and May 1984).

Psychological Characteristics. The picture thus far is that inhalant users are a group with serious social and societal problems. Early studies suggested that inhalant users might suffer from greater emotional distress. Case studies, for example, suggested that inhalant users might be anxious and depressed (Weise et al. 1973). Inhalant users have higher scores on the Taylor Manifest Anxiety Scale, have been treated more often for emotional problems, and are more alienated (Fejer & Smart 1973; Smart et al. 1972). More adolescent delinquents who used inhalants are depressed than adolescent non-inhalant users who used other drugs (Jacobs & Ghodse 1988). There is some evidence that inhalant users are lower in self-esteem. One study found lower self esteem and satisfaction with social relationships (De Barona & Simpson 1984). Another found inhalant users were lower in variables that would logically relate to self-esteem (Annis et al. 1971).

Inhalant users do seem to suffer from greater emotional distress, and there are hints that some inhalant users may indeed have serious personality disorders (Dinwiddie et al. 1991; Swadi 1996). A long-standing pattern of drug use alone, particularly when accompanied by other deviant behaviors such as with inhalant users, could lead to a diagnosis of personality disorder or antisocial personality disorder. An adolescent reaction to the family problems that are often associated with inhalant use (broken families, family hostility, and aggression) could easily lead to a diagnosis of adjustment disorder in an adolescent, another diagnosis that has been applied to inhalant users in some studies. The signs of emotional distress and the behaviors of inhalant users could equally be simply an outcome of the social and family problems and social environment of the inhalant user, and not a result of personal psychopathology.

Peer Drug Involvement. One stereotype of the heavy inhalant user is that of the social isolate or "loner." Research reports, however, are highly consistent in describing most inhalant use as a group activity. In an early report on inhalant-using youth in Texas, about three-fourths of inhalant use occurred with other youth (Stybel et al. 1976). Among London delinquents, 75 percent of users inhaled with friends (Jacobs & Ghodse 1988). Among adolescent users in Northern Ireland, nearly 80 percent inhaled with friends (Lockart & Lennox 1983). More than 80 percent of Brazilian "street kids" used with their friends (Carlini-Cotrim & Carlini 1988). Among Native-American children in a boarding school, sniffing was typically done in a group (Schottstaedt & Bjork 1977). Among poor Hispanic youth, 90 percent used with their friends (Guitierrez et al. 1978).

The kinds of friends that inhalant users have may be an important factor in their inhalant use. Inhalant users may have a narrower group of friends, with higher deviance among them. While family sanctions against inhalant use tend to be high, even in the families of inhalant-using youth, sanctions against inhalant use by peers are much lower (Bachrach & Sandler 1985; Beauvais et al. 1985). Chronic inhalant users in Texas spent more time with their friends and their friends were more deviant (DeBarona & Simpson 1984). Friends of inhalant users may use more drugs (Mata & Andrew 1988), and the friends of inhalant users are also

likely to be using inhalants (Bachrach & Sandler 1985; Oetting et al. 1988; Stephens et al. 1978).

In general, more than three-fourths of inhalant use is probably with friends. This leaves a considerable gap, however, showing that a significant amount of inhalant use does occur when the user is alone. From general experience of those working with inhalant users, solitary users seem likely to be more disturbed and have more problems. Only one study compared those who use alone with those who do not, and it indicated that there was more psychopathology in those who used alone (Guitierrez et al. 1978).

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Adult patterns of use are less well documented. From the descriptions available, adult use is probably more social than that of adolescents. The milieu of use is typically that of a stereotypic "skid row". Groups of adults will share resources, share inhalants and engage in prolonged binges lasting several days. These bouts are usually marked by sexual promiscuity, poor nutritional intake and the danger of exposure. Alcohol will be used and shared when available. Fredlund (1994) found among adult Kickapoos poverty, low educational attainment, cultural distinctiveness and cultural isolation, as well as physical health and safety problems for these adults and their children.

Culture. The location of "hot spots" of inhalant abuse in Hispanic barrios and on Native American reservations suggests the possibility of cultural influences. Studies that show differences in drug use rate related to ethnicity usually assume that the problems are occurring because youth are caught between two cultures (Gilbert 1983; Guitierrez et al. 1978; Nurcombe et al. 1970). There are, however, almost no actual studies of the cultural identification of minority youth and how that relates to inhalant use. When such studies are conducted, they should carefully control for socioeconomic status. Many studies have not done so and wrongly conclude that certain cultural beliefs and values lead to substance abuse when the real cause is actually socioeconomic.

The most serious levels of inhalant use may occur in specific drug-oriented subcultures. Perhaps the most extreme example of a subculture is reported in a study of Mexico City "street kids" who essentially severed all ties with their families and formed their own subculture, probably to replace the family (Leal et al. 1978). Another example is among the adult members of the Kickapoo people living in Eagle Pass, Texas (Fredlund 1994).

REASONS FOR USE

When inhalant users are asked why they use, some common themes are noted: (1)desired euphoric effects ("it feels good"); (2)easy availability; (3)low expense; (4) possession is not clearly illegal (avoidance of legal hassles); (5) convenient packaging; (6) gives fast and multiple highs (which is particularly attractive to young children who want quick gratification); (7)adolescent expression or rebellion; (8) easier to hide from or explain to parents than alcohol or marijuana; (9) alleviates stress; and (10) peers approve of or insist on use, which enhances peer respect because use is "cool."

Discerning the link between awareness and behaviors is a complex problem, and is compounded by the drug user's frequent inability to fully recognize or verbalize motives for drug use.

BEHAVIORAL CUES

Many behavioral cues present in a drug-use setting can trigger continued drug use. These cues are important indicators for treatment and prevention regimens. The following are among the most common: time of day; day of week; a certain person; smell; taste; a particular street, neighborhood, house or building; an emotional feeling (anger, loneliness, depression, sadness, boredom, hurt feelings); a social gathering or a group of people; a memory (good or bad); success or failure (some take drugs to celebrate, others to forget); alcohol and other drug use (use of one drug may disinhibit the user and thus encourage other or continued drug use).

ADOLESCENT REBELLION

The root problem of inhalant abuse may have more to do with normal stages of adolescent development and adolescent rebellion than with inhalants per se. Youth may like inhalants because they shock, confuse and disturb their parents (Gregory 1986). These youth could merely be acting out their normal stages of adolescent rebellion, a period in which youth test the boundaries of autonomy and independence versus dependence. Inhalant use may also be a way to get parental attention. In this regard, inhalant abuse may be more a problem of adolescence than of drug abuse (Duncan 1986).

MORTALITY

Although toxic drug effects can and do directly cause death, deaths among inhalant users are also indirectly related to use. Death appears in at least five ways: (1) asphyxia (solvent gases can significantly limit available oxygen in the air, causing asphyxiation); (2) suffocation (typically seen with inhalant users who use bags); (3) choking on vomitus; (4) careless and dangerous behaviors in potentially dangerous settings (e.g. explosions & fire); and (5) sudden sniffing death syndrome most often from cardiac arrest (Tenenbein 1990).

In a San Antonio study of inhalant deaths, the most prevalent mode of death was suicide (28 percent) (Garriott 1990). A large majority of inhalant suicides hung them-

INHALANT USE/VIOLENT DEATH

The Bexar County Medical Examiner's Office has investigated all cases of death related to inhalant abuse occurring during a recent 6-year period in Bexar County, Texas. Thirty-nine cases had inhalant chemicals detected by screening of blood or other suitable specimens, and were initially identified by circumstances suggesting inhalant abuse, external physical signs at autopsy, or by toxicological screening of high risk deaths. Although few deaths were found to be directly due to inhalant toxicity, a striking correlation was made relating inhalants with violent death. The most prevalent manner of death was suicide (28 percent of cases) followed by accident (26 percent), homicide (23 percent), and inhalant-induced death (18 percent). By far, the most predominant inhalant agents used were compouonds containing toluene (32 cases, representing 82 percent), although toluene was considered the cause of death in only one instance. The mean toluene concentration in blood in 32 cases was 3.78 mg/L. All other inhalants (trichloroethane/trichloroethylene, nitrous oxide, gasoline and freon 12) were detected in only seven of the cases. The high rate of suicide and violent death in these inhalant abusers while under the influence of the chemicals is suggestive of neurotoxicity.

— *James C. Garriott, Ph.D., D-ABFT*

selves (91 percent) in contrast to the relatively low use of this method of suicide by non-inhalant users (18 percent). In addition, the study found that only a small percentage of the inhalant-user deaths (18 percent) were due to inhalant-induced cardiac arrhythmias. Overall, 77 percent of deaths of inhalant users were by violent modes (suicide, homicide and accident), rather than as direct consequences of drug toxicities.

Another study (Maxwell 1994) found persons who died of inhalants in Texas in 1990-1993 were male (94 percent), Anglo (90 percent), and average age was 26. Close to half of the deaths each year involved freon and the occupations of decedents included air conditioning technicians, engineering technicians and pipefitters.

EFFECTS OF INHALANT USE

The reports from most inhalant users indicate that the perceived effects mimic the intoxication produced by alcohol. The initial effects are lightheadedness, tingling sensations, agitation and a sense of euphoric exhilaration. Further, there is a sense of well-being and power. From these perceptions, one would think that inhalants are stimulants, but prolonged use, as with alcohol, demonstrates that the primary action is one of a physiological depressant. Later effects include dizziness, blurred vision, poor judgment, loss of contact with reality, slurred speech, unsteady gait and, with a sufficient dose and duration, loss of consciousness. There are some reports that heavy doses of inhalants will also produce hallucinations, both visual and auditory. Several hours after use, lethargy and headache are common.

Neuropsychological problems. From the perceived and observed effects noted above it is clear that there is some level of impairment due to inhalants in the short term. Additional evidence for this comes from studies of neuropsychological studies of inhalant users. (Neuropsychological functioning refers to such things as intelligence, memory, problem solving, and visual, auditory and tactile perception). For instance, Korman et al. (1981) found that inhalant users performed more poorly on a number of neuropsychological tests including IQ measures and various measures of perception. It should be noted that these studies did not control for length of abstinence from inhalants, nor for problems that may have existed before inhalants were used. In a general review of this issue, Chadwick and Anderson (1989) concluded that, while most studies do show neuropsychological deficits in inhalant users, it is difficult to tell how extensive these are, or how long-lasting they are due to the many methodological problems already discussed.

Neurological problems. For a number of reasons, there is a modest degree of uncertainty as to the nature of the physical effects of inhalants. First, the high degree of variability and the combinations of chemicals in commercial and industrial compounds makes it very difficult to determine a direct effect from any particular chemical. Second, the degree of physical impairment is related to the dose and duration of use, factors which are difficult to ascertain from users. Third, there is the important question of the degree to which physical damage will be reversed upon cessation of use. Fourth, it is difficult to sort out problems that may have been in existence prior to the onset of inhalant use. Finally, many studies do not make a distinction between acute and chronic effects. For example, many neurological studies take place while inhalers are intoxicated and draw the conclusion that the effects found will be permanent. It should be recognized that inhalants are lipophilic which means they are deposited in fat tissues in the body and leach out into the bloodstream over an extended period of time. Tests for chronic effects should take place after an extended period of abstinence. Despite these problems, there are some commonly agreed upon physiological effects from the use of inhalants.

Tests for brain damage suffer from many of the same methodological problems listed above. Rosenberg and Sharp (1990), Ron (1986) and Dinwiddie (1994) reviewed the existing studies and came to essentially these conclusions: While a number of studies have revealed brain abnormalities (e.g. through CAT and MRI imaging), it is not clear whether these were preexisting conditions, they existed in all inhalant users and whether these problems will reverse over time. A very recent and comprehensive review of all of the evidence, including that from animal studies, leads one to the conclusion that some lasting damage does accrue but it is difficult to detect except in chronic, high dose users. (Sharp & Rosenberg, in press).

These conclusions raise a major question—does the use of volatile solvents result in the level of brain damage that is commonly held among research and treatment professionals? What we know so far would indicate that the level of injury is not as severe as some think.

For a number of reasons, inhalant use *does* constitute a dangerous behavior and this danger should not be minimized:

1. **Current methods of assessment may not be sensitive enough to detect injury that may persist over time. Some studies have shown that among chronic, heavy users there is an actual loss of neural tissue (e.g. Fornazzari, 1983) so there is some reason to suspect that some neural loss is occurring among most heavy users.**

2. **Death can and does occur among inhalant users, (Garriot 1990; Cunningham et al. 1987; Bass, 1970; Maxwell 1994; Tenenbein 1990), some from first time use. The causes of death have already been discussed but bear repeating; asphyxia (commonly from plastic bags over the head), cardiac arrhythmias and failure, violence (both homicide and suicide), and accidents such as explosions, fires and head injury from passing out.**

3. **There are some inhalants that are known to cause permanent damage (e.g. compounds containing hexanes produce irreversible peripheral nervous system damage and other compounds cause hearing loss). It is difficult for the user to know whether the compound they are using contains the chemicals leading to these problems.**

Non-neurologic effects. In addition to the dangers already discussed, there are other medical problems that have been detected among solvent abusers; some of these involve acute crises that require immediate medical attention. Linden (1990) has reviewed the medical literature which indicated that there are heart, liver, kidney, blood and lung complications that accompany moderate to heavy use of inhalants (not all inhalants cause all of these problems). For the most part, once the immediate medical crisis had been managed, these problems tended to resolve with time.

PSYCHOLOGICAL AND SOCIAL EFFECTS

As with the use of any other drug, the use of inhalants is not without its effects on an individual's psychological and social functioning. It has been shown that inhalant users often have a number of other psychological problems (Dinwiddie et al. 1987; Oetting et al. 1988; Swadi 1996) and the continued use of inhalants will only exacerbate those conditions. In particular, the cognitive confusion caused by inhalants will only interfere with any therapeutic interventions or attempts to maintain a competent lifestyle.

Problems in family, work and school adjustment are also hallmarks of inhalant users.

SIGNS AND SYMPTOMS

Signs and Symptoms Most Frequently Reported in Long-term, Heavy Users of Toluene-Containing Solvents

Short-term memory loss
Emotional instability
Cognitive impairment
Slurred and "scanning" speech
Wide-based ataxic gait
Staggering or stumbling
Nystagmus
Ocular flutter
Tremor
Optic neuropathy
Unilateral or bilateral hearing loss
Loss of sense of smell
Diffuse slowing of the EEG
Abnormal or absent brainstem auditory-evoked response
Diffuse cerebral, cerebellar, and brainstem atrophy
Enlarged ventricles and widening of cortical sulci, especially in the frontal or temporal cortex

— *Gordon T. Pryor, Ph.D.*

Once again, amelioration of these problems is extremely difficult for an individual whose intellectual capacity is compromised by the use of inhalants. Furthermore, existing problems are only extended by inhalant use. Families will be more rejecting of youth who are using inhalants, and schools will be reluctant to provide educational and supportive services. Continued inhalant use into later adolescence is seen as an aberration even among peers leading to rejection in this important developmental arena. Inhalant using youth are marginal in many ways and the time used in obtaining, using and experiencing the effects of inhalants only serve to move them further away from normal socializing influences. Inhalants have not been shown to be addicting in the sense of exhibiting tolerance and withdrawal, yet the powerful psychological dependence that users report make it extremely difficult to stop use and engage in normal developmental tasks.

RESEARCH NEEDS IN STUDYING INHALANT EFFECTS

Given the complexity of inhalant abuse, interdisciplinary research is necessary to effectively study the observed toxic effects of inhalants on humans. Contributing disciplines could include chemistry, pharmacology, medicine, psychology, psychiatry, sociology, child development, social psychology and group influence, and quantitative test and measurement specialties. Listed below are some of the desirable data elements for comprehensive studies.

Type of Substance Used. Relevant chemical and pharmacological data on inhalants might include the type of substance used; the specific formulation; the nature and degree of its impurities; the volatility, potency, and resultant metabolites; the dose response curve; and the effects when used alone as compared to when used in combination with other chemicals.

Mode of Administration. Helpful sociological data would include the mode of administration (cloth, aerosol, bagging or huffing, heated volatile) and whether it was by mouth, nose, gastrointestinal routes, or skin absorption.

Drug Interactions. It is essential to know if other drugs are used consecutively or at the same time with the solvent; what interaction effects may have occurred such as adaptivity, synergism, antagonism, or independence; and whether observed effects were complicated by withdrawal or tolerance. Data on the user's drug history are also essential.

Developmental Issues. It is important to know the user's position in the drug depen-

dence cycle (for example, whether (s)he is a novice or chronic user). Information on adolescent rebellion could help explain the user's systematic or unpredictable use of solvents as well as the types of negative effects (social-behavioral and/or toxicological).

Dose. The amount of inhalant used may relate to mode of administration, potency of the solvent or its volatility, developmental factors, and social psychological factors such as duration of individual exposures and shared use among peers.

Reversibility of Damage. There is a common perception that inhalant users incur immediate and substantial brain damage. This perception leaves many practitioners, particularly in the treatment area, with the sense that there is little that can be done for these people. Accurate measurement of the extent and type functioning that can be recovered would be of great benefit to both those treating inhalant users and the users themselves.

Style of Use. Social psychological data could distinguish between episodic or continuous use, ascertain the dose and duration of exposure per drug-taking occasion, pinpoint the time lapsed between exposures, and determine whether the solvent is used alone, shared with peers, or combined with other substances.

Health Status. Medical data about the user's general health could help distinguish the observed effects of inhalants from the user's other medical conditions such as nutritional status, cognitive impairments, extant neurological damage, hepatitis, and other organ dysfunction.

Mental Health. A variety of psychological and psychiatric conditions can cloud relevant psychological test performance measurements, and distort the user's self-reported accounts of perceived inhalant effects.

Measurement Errors. Many measurement errors disrupt research of inhalant users, particularly those involving the source of subjects and the truthfulness of self-reports. Because inhalant use is a relatively rare phenomenon, locating appropriate test subjects is difficult. The setting from which subjects are taken can influence study results. For example, treatment clients are likely to be the most severe cases with multiple complications. The general inhalant user typically does not seek treatment, and those that do may not be typical of the user population. Subjects that are involved in the criminal justice system may be less likely to fully report their drug use or its effects for fear of further legal penalties. While subjects from school-based settings are useful, many inhalant users are often not in school. Similarly, data from household settings exclude the large number of homeless inhalant users.

Another concern is the truthfulness of the inhalant user's self-reports on use, as well as responses to a variety of interview questions. Self-reported data can be influenced by whether or not the subject is involved with the criminal justice system; by self-perceived stigma in reporting solvent use, and related deviant behavior; by cultural or peer-group taboos; or by the subject's accuracy in remembering his/her behaviors (due to inattention, memory loss, withdrawal effects, or other cognitive or neurological impairments).

TREATMENT OF INHALANT USERS

Treatment of inhalant abusers must incorporate effective outreach, screening and diagnosis; involvement of the family in the therapy; consideration of environmental and behavioral influence; and appropriate selection of the treatment regimen (client/treatment matching).

PROBLEMS IN OUTREACH

The four basic problems in conducting outreach are as follows: (1) inhalant users do not typically seek treatment, thus only the most severe cases are observed in clinical settings; (2)inhalant users are often not in school, so school-based treatment and prevention/education may not reach many of the users; (3) home-based case-finding is ineffective for the homeless; and (4)involvement of the family in the treatment process is necessary. When treatment is focused solely on the youthful client, without family involvement, relapse is likely (WHO 1986).

The families of many inhalant users have been described as extremely chaotic and early assessment of family functioning is essential. It may well be determined that the family is not at a point where they are capable of making the needed therapeutic changes and alternative short or long-term foster placement of an adolescent should be considered (Jumper-Thurman & Beauvais 1992). It has also been observed that, once identified, inhalant users are reluctant to enter treatment and will often leave treatment in the early stages. Careful work must be done at this stage to insure continued compliance with treatment. Most clinicians who work with inhalant users recognize that users are very wary of professionals and physiologically are very sensitive to strong stimuli; thus strong, confrontive interactions should be avoided as users are brought into the early stages of treatment.

SCREENING AND DIAGNOSIS

Due to the wide range of problems encountered by inhalant use, a thorough assessment of all areas of physical, psychological and social functioning is necessary. While this is standard practice in most drug abuse treatment, it takes on added importance with inhalant users since the level of dysfunction in any one area may seriously impact another. A thorough physical exam should be performed to rule out acute system problems that may need attention before treatment for inhalant abuse can begin (Linden 1990). A careful history of length and intensity of inhalant use is useful in determining when and at what level treatment can begin (See "Detox" below). An inventory of family, peer, educational and occupational resources (or deficits) should be conducted early on since restructuring in all of these areas may constitute a major part of treatment (Jumper-Thurman & Beauvais 1992). Discharge and aftercare plans should begin with the assessment process and continue throughout the course of treatment. Where resources are available, a neurological examination at intake can be helpful in assessing level of neurologic injury and functioning.

Neurotoxic disorders due to inhalant use can be confused with other conditions, and mild cases of neurotoxic injury are very difficult to diagnose (Rosenberg 1990). Although diagnoses are difficult to make, individuals do develop a similar clinical picture when exposed to solvents at equivalent doses for equivalent durations of time (Rosenberg 1990). The use of MRI (magnetic resonance imaging) is a potent procedure to detect abnormalities in users (Rosenberg 1990). Current technology can detect abnormalities in brain structures, and continuing advances offer great promise for enhanced screening and diagnosis in the future.

DETOXIFICATION

Detoxification is typically seen as the time during which a drug or alcohol user is recovering from the acute effects of the substance they have been using. For most drugs this is usually less than a week. After that time, most of the chemical is out of the individual's body and they are then ready to engage in the therapeutic process. Detox time for inhalant users differs from this schedule in a number of ways. First, given that inhalants are stored in fatty tissue in the body and are slowly leached back into the blood stream, it may be several weeks before the direct action of the chemicals is no longer present. Second, although much of the neurological damage from inhalant use is reversible, this healing process takes considerable time. Finally, at the point that many inhalant users enter treatment, their nutritional and general health status is seriously compromised. As a result of these conditions, the detox period for many inhalant users is more extensive than for other drug users (Jumper-Thurman & Beauvais 1992; Fredlund 1994; Sharp & Rosenberg, in press). At the initiation of treatment, many users are lethargic, physically weakened and cognitively confused. Premature attempts to implement therapies that require energy and clarity of thought will only lead to failure and frustration, both on the part of the patient and the treatment staff.

There is no agreed upon standard period of detoxification for inhalant users although it is clear that the usual 30-45 day treatment regimen typically employed with substance abusers is inadequate. It may take this amount of time simply to get the user to the point where therapeutic gains can be made. The above, of course, is a generality and each patient must be assessed individually. Detox and total treatment time will vary according to the level and duration of solvent use, the basic health of the individual and the repertoire of other social resources that can be brought to bear on the process of recovery, and periodic assessment of cognitive function is required to monitor changes and determine readiness for more therapeutic interventions (Fredlund 1994).

LIFE SKILLS

Many solvent users have become socially marginalized throughout the time they have been involved with inhalants. Many lack basic social and health care skills; they may have experienced academic failure and have not developed the minimal competencies for holding a job. Further, they may be socially inept and have learned to interact with others only through aggressive (or even passive) means. All of these elementary issues are of importance in the early stages and throughout the course of recovery. Clearly, treatment must involve collaboration with a wide range of community resources. Given the initial level of deficits, aftercare and follow-up are of extreme importance when working with inhalant using patients. In addition, due to cognitive problems, organized activities should be brief (20 minutes) and varied and deal with concrete subject matter consistent with the limited attention span and capacity for abstract thought of clients experiencing acute effects of neurotoxicity.

PEERS

The social world of many inhalant users has become very constricted and they tend to associate only with a small group of indi-

viduals who are also heavily inhalant involved (Oetting & Webb 1992). This pattern is somewhat characteristic of all drug users but seems to occur more commonly among inhalant users. A major task of therapy, then, is to both break these peer bonds and to resocialize the users into a new peer environment. Lack of contact with the previous peer structure is essential throughout the course of treatment.

FAMILY TREATMENT

There are at least ten needs that should be attended to in treatment, and which should be understood by the parents (Glenn 1981):

1. **Children need to be able to exercise self-discipline, self-assessment, and self-control.**
2. **Children need to develop self-esteem.**
3. **Children need clearly defined limits.**
4. **Children need the ability to operate successfully within a system (for example, if they skip homework one night, then they must do it in the morning; if they skip doing homework too often, then they loose the privilege of playing school sports).**
5. **Children need confidence that they can affect what happens to them. If they see themselves as victims, they will turn to drugs; if they do not learn to operate within limits, then they will not learn how their own acts affect them.**
6. **Children need the ability to make judgments, which they learn by being with mature adults (example combined with dialogue).**
7. **Children need positive role models.**
8. **Children need skills for working effectively with others.**
9. **Children need to feel they are loved and valued.**
10. **Children need open, honest communication with their parents.**

Treatment of young drug users is significantly enhanced by the involvement of the family in the treatment regimen, and is best when individually tailored to client needs (Szapocznik & Kurtines 1989; Stanton & Todd 1982; Rubin & Babbs 1970). Children have many needs which, if unmet in the family, may foster drug use: "Any reliable prevention or treatment program must provide the means to substitute non-harmful activities that satisfy these users' needs for gratifications sought previously in solvent sniffing" (Kerner 1988, 9). When designing treatment, it is essential to analyze the children's needs and the role the family plays in satisfying those needs in order to teach drug abuse resiliency factors.

TREATMENT MATCHING

Matching clients with specific, individualized treatments is a relatively new focus in treatment of alcohol and drug addictions (Hester & Miller 1989; Gottheil et al. 1981). Because inhalant users are different from the general drug users, different treatment and prevention strategies must be applied (Giovacchini 1990), because "it is not clear if approaches to working with alcohol- and marijuana-using youth are effective with inhalant-using youth" (Mata & Andrew 1988, 71). The challenge for inhalant treatment approaches is to tailor the regimens to the differing target populations. Some have even questioned whether inhalant abusers can be treated in a general drug abuse treatment program or whether dedicated programs are needed (Jumper-Thurman & Beauvais 1992).

There are three major considerations in client-treatment matching: (1) matching specific treatment to the specific needs of the youthful inhalant user and the user's family, (2) matching both the client's and the therapist's cultural status and cultural sensitivity, as well as the cultural relevance of the proposed interventions, and (3) matching the global therapeutic approach to the client's mental abilities and emotional de-

YOUTH ADVOCACY PROGRAM STUDY: METHOD

A total of 175 Mexican-American youth (aged 13 to 17 when they entered the Youth Advocacy Program (YAP) between March 1981 and December 1985) were targeted for followup. An examination of inhalant use reported by these 175 clients at admission to the YAP showed that 35 (20 percent) used at least weekly in the 2 months prior to YAP (Weekly—Group 1), another 42 (24 percent) used at least once a month (Monthly—Group 2), 34 (19 percent) had used previously but not in the prior 2 months immediately before admission to the YAP (Experimental—Group 3), and 64 (37 percent) had never used inhalants (Never Used—Group 4). These clients stayed in the program an average of approximately 13 months, during which time they received individual counseling and participated in a variety of recreational activities, cultural enrichment, academic tutoring, and related life-skills training. Unfortunately, detailed client participation records were not available in this study for specifically evaluating these services.

Private face-to-face followup interviews provided information about drug use patterns and related problems over time. Behavioral outcome measures were examined in regard to acculturation and background factors, psychosocial adjustment indicators, and parental and peer relations. Clients were not assigned to be interviewed as part of the followup study until at least two years after entering YAP. The interview period began October 1987 and was completed in April 1988, an average of over four years after admission to the YAP.

Of the 175 cases in the target sample, 150 (86 percent) were successfully traced; 110 (63 percent) gave informed consent and were interviewed. Of the 110 completed cases, 79 percent of the mothers were also interviewed. Incentives of $10 were paid for each completed interview. In order to conduct several basic toxicological evaluations of recent drug use and organ system functions, a subsample of the interviewed youth were asked to provide blood and urine specimens. For another $10 incentive fee, 44 out of 59 youth who were asked agreed to participate (75 percent) and were taken to a medical laboratory where body fluids were obtained for analysis.

— *Dwayne Simpson, Ph.D.*

velopment. From a global perspective there are at least seven therapeutic approaches: (1) *Behavioral,* which aims to control and/or change maladaptive behaviors and increase or teach adaptive behaviors; (2) *Cognitive,* which seeks to correct maladaptive cognition; (3) *Developmental,* which seeks to remedy structural deficits in ego development; (4) *Exploratory,* which seeks to increase understanding and resolution of intrapsychic problems and conflicts; (5) *Psychopharmacological,* which considers medications to be the prime treatment, or as treatment adjuncts; (6) *Supportive,* which offers help to manage problems in daily life by strengthening available coping skills; and (7) *Systemic,* which focuses on restructuring patterns of interactions and communications as well as roles in family or social systems. Given the complexity of inhalant abuse, most of these approaches may be appropriate and necessary.

Treatment of the inhalant abuser is often complicated by the presence of multidrug and polydrug use. During the early stages of treatment, questions about why the user takes drugs and the user's perceived needs assures the youth's active participation in the treatment process. During later stages

of treatment focus can shift to more psychodynamic considerations. Finally, because quick action of the drug appeals to people who want instant gratification, aspects of treatment can focus on teaching the user how to delay gratification. The need for immediate gratification often affects all aspects of the user's life, and is an important topic for treatment.

A PERSPECTIVE FOR COUNSELORS

An understanding of the origins of inhalant abuse is necessary for effective treatment and prevention. Treatment regimens can be structured around what youth want but feel they do not have. Youth look for guides and teachers, and finding few or none, experience alienation. Youth also crave relation, security, affection and acceptance; gangs and peer groups often offer these. In fact, the ceremony of sharing drugs draws youth together and at the same time sets them apart. As families unravel, youth turn to one another for sustenance. Perhaps the family's most important legacy to the young is a sense of self, developed through rich familial communications, rather than merely discipline or morality. What parents see as adolescent rebellion may be no more

YOUTH ADVOCACY PROGRAM STUDY: SUMMARY OF RESULTS

The study focused on "high-risk" youth whose average age at intake was just under 15, and average age at followup was 19. Analysis at intake indicated that the four groups of inhalant users -- Weekly, Monthly, Experimental, and Never Used -- were generally comparable in terms of sociodemographic characteristics, but use of alcohol and other drugs, as well as legal involvement measures, were directly associated with level of inhalant use. Followup analysis indicates that these trends remained intact: youth who were heavier inhalant users at intake continued to have more negative outcomes four years later.

The group of weekly inhalant users had lower employment rates, higher prevalence of arrests and illegal activity, and more drug use than the other groups. At least two-thirds of each group used illegal drugs in Year 4 of the followup, but this was true of 95 percent of the weekly users. About 45 percent of the weekly users consumed on average more than four ounces of 80-proof liquor equivalent per day. The only exception to the continued tendency to use more kinds of drugs by the weekly inhalant user group involved cocaine. Preadmission cocaine usage was 10 percent for the total sample, but it escalated to 31 percent at followup; in contrast to all other drug categories, the preadmission group of weekly inhalant users had the lowest level of cocaine prevalence in Year 4.

Based on the subsample of 44 individuals for whom blood specimens were collected and analyzed, laboratory results for one out of three youth showed evidence of liver problems, and were more pronounced among those with the most extensive histories of inhalant use. The use of other drugs was related to other blood test abnormalities, but not to liver problem indicators. Youth with more extensive inhalant use histories reported more cognitive problems involving clarity of thinking, decision making, concentration, and remembering details. Over one-fourth of these youth had experienced suicidal thoughts, and one-fifth had made at least one suicide attempt.

— *Dwayne Simpson, Ph.D.*

than the youths' imitation of their parent's patterns of escape (e.g., alcohol, coffee, tobacco, and pills). In this sense one does what one sees, namely to use drugs to change things or evade them.

It has been said that culture and class conditions can imprison youth, teaching them what to feel and avoid, what is allowed, and what is taboo. Drugs may offer a release from these pressures. On the other hand, some cultures sanction ceremonial drug use to achieve transcendence, and these rituals and ceremonies serve significant communal needs.

Given the indications that neither traditional psychotherapeutic approaches (Comstock 1978; Guyer-Christie 1978) nor standard drug rehabilitation (Dinwiddie et al. 1987) have been wholly successful with inhalant users, there is a need to explore alternative treatments, particularly with young adult users, such as vocational counseling and testing, job-training and placement, training in employment interviewing skills, methods to develop good work adjustment habits, and learning to conform to the work environment (Oetting 1990). The most formidable problem confronting treatment may be the specter of relapse: "The patient who is completely drug free, imbued with all types of motivation to remain drug free, but with no job, no insight into how to sustain a relationship, often [struggling with] major psychiatric problems—that is the person who is a big candidate for relapse" (McLellan 1990, 6).

PREVENTION OF INHALANT USE

Selecting appropriate, effective, and viable prevention efforts is one of the most difficult problems in the inhalant abuse field. Prevention efforts must be timely, especially in inhalant work, because of the ever-changing nature of use patterns, as well as the substances abused. Many drug findings are time-bound, thus results from two decades ago are no longer relevant to today's prevention efforts (Trimble 1990). Prevention approaches can be thwarted in often unanticipated ways; the following problems are the foremost among the many confronting prevention efforts.

A Relatively Infrequent Event. Because inhalant use is infrequent among adults, prevention efforts typically focus on drugs more commonly abused by adults; however, inhalant prevalence is relatively high among youth, and should be a priority focus of prevention efforts targeted at youth.

Limited Fiscal Resources. Because fiscal and personnel resources in many health care systems are limited, attention is directed to the drugs commonly abused by adults. Resources for inhalant research are limited in general, making it even more difficult to fund much-needed (but very expensive and methodologically complex) longitudinal studies (Cresson 1990).

Limiting Availability. In practice it has been impossible to limit availability of volatile, inhalable substances (WHO 1986). If legal sanctions are applied to limit the availability of the volatile substance, then users will shift to other easily available solvents with potentially more toxic effects. Limiting only the most detrimental solvents might be insufficient; it may be necessary to ban even mild or relatively harmless drugs if toxic interaction effects occur when these mild substances are mixed together. Because volatile solvents are licit rather than illicit drugs, they pose special problems in prevention because total prohibition is unlikely, and criminal sanctions are not a viable deterrent to their use.

Criminalization of the User. In some places it is illegal to sell inhalants to minors, or for minors to use inhalants for sniffing purposes; some inhalant abusers are mandated to treatment. Careful evaluations of such approaches have yet to be made. One report concluded, "In general, legal sanctions against inhalant abusers is not a preferred method of prevention. Such sanctions do not appear to reduce abuse and they create additional problems for users." (WHO 1986, 28)

Chemical Deterrents. Adding deterrents (foul-smelling or irritating substances) to solvents to discourage use is no longer a prime avenue of prevention for at least four reasons: (1) users would likely switch to other, potentially more toxic solvents if the deterrent were too noxious; (2) the user may not interpret their effects as noxious, or might even like the dare-devil aspects of use; (3) the legitimate uses and users of the substance might be adversely affected; and (4) commercial manufacturers would fear a reduction in product sales. Many of the deterrents that have been explored were deemed too noxious, too toxic, or unstable (Giovacchini 1990).

Chemical Reformulations. In developing prevention approaches, one must consider if the cure is an effective preventive procedure. In Canada, polish removers have been made "oily," which makes them less volatile and does not release fumes as rapidly. Although intoxication can occur, it takes longer for users to experience the effect. In another example, the solvent component of liquid correction fluids was replaced by a water-based component which was clearly safer, but took much longer to dry. Neither the legitimate consumers nor the illicit inhalers found the product satisfactory, and thus its use and sales diminished significantly.

Chemical Packaging. While some argue that labeling a product's side effects would deter use and alert parents, others note that product-labeling would also pinpoint products that give a high (Giovacchini 1990).

Information Dissemination vs. Media Contagion. Although it has been suggested that mass media reports should not contain detailed information on what products are being sniffed or just how it is being done (WHO 1986, 32), it is difficult to ride the line between information dissemination and censorship, and to prevent the exchange of information on drug practices between youth and their peers. For example, several companies produced an educational film on the detrimental effects of sniffing, but the films were never released because people argued as to whether the films would deter inhalant use, or introduce youngsters to a new mode of administration or new products and inadvertently increase use (Giovacchini 1990). The following issues must be considered carefully before disseminating information.

Target Groups. One must distinguish carefully the target groups of prevention messages. Prevention messages aimed at non-users will, by necessity, be unlike those aimed at the inhalant user (Ives 1986). In general, the non-user has different attitudes, often negative, toward inhalants than the user. At issue is whether the message should be abstinence (a potentially appropriate message for non-users) or harm reduction (a potentially more useful strategy for chronic inhalant abusers). A related issue is the role inhalants play in initiating subsequent drug use: if inhalants are effective gateway drugs to other use, then prevention efforts are best focused on those who have not yet begun any drug experimentation.

Stigma is a subtle but insidious problem that arises when media (as well as research) coverage identifies and links certain groups with inhalant abuse. For example, by the time Native American youth reach their senior year, only 4 percent are using inhalants seriously enough to warrant concern (Oetting et al. 1988). Therefore, to label all these youth as inhalant users is stigmatizing.

Since prevalence of inhalant abuse is not uniform across locales (Smart 1988), effective prevention efforts should target not only specific users, but also specific regions. Target areas could be populations with high prevalence rates, or communities with few social assets and undergoing rapid acculturation changes.

Abstinence vs. Harm Reduction. Prevention messages in the addictions can range from total abstinence to harm reduction. For example, in the alcohol field abstinence is a common message aimed at young people, while moderate, responsible drinking is a prevalent message with college students. Whether clean needles should be freely dispensed to intravenous drug users (a harm reduction approach), or whether they should not (an abstinence approach) is another case in point. The former approach is based on the notion that current treatments and prevention have not been successful; consequently, partial prevention successes (harm reduction) are worthwhile, albeit as a first step.

However, applying the harm reduction model to the use of inhalants should be seriously questioned. Unlike most other drugs, inhalants have the potential to kill, even for first time, naive users. Second, most inhalant use takes place at a very young age compared to other drugs and a message that says "Use it, but be careful" is inappropriate for this age group. It is one thing to counsel a college student about prudent use of marijuana, but quite another to give the same message to a 13 year old who is already experiencing psychological and social problems (Beauvais 1996).

Scare Tactics. Scare tactics have never been shown to be an effective deterrant to drug use. Children may not believe exaggerated negative messages since these conflict with their own observations of effects. As a result, children may disbelieve other prevention messages, since the source seems unreliable. Over-reliance on scare tactics (such as legal ramifications) may further remove youth from the social fabric and engender disrespect for the law, authority figures and social structures. In addition, programs emphasizing the negative social consequences of drug use may cause increased use, since inhalant users may regard rejection by "good kids" as an asset, not a liability, and only push inhalant users to affirm their deviant peer culture groups (Oetting 1990).

Legislative Efforts. Legislative efforts against inhalant abuse are best categorized as semi-interdiction approaches with the aim of keeping the drugs out of the hands of youngsters. Because of commercial considerations, full interdiction is not feasible. Legislation has been product-based, abuser-based, and supply-based. Product-based legislation has included warning labels, use of deterrents, repackaging, and reformulation. Abuser-based legislation has made it illegal to sniff or to be high from sniffing (thus labeling the user as a criminal), and has imposed mandatory treatment if caught sniffing. Supply-based legislation has placed age restrictions on purchasing, made it an offense to sell products to a minor for sniffing purposes, and placed a total prohibition on availability of some products.

Many of these efforts have been thwarted because of the following: (a) fear of drug substitution (users would switch to other drugs not legislatively controlled); (b) fear of media contagion (the problem of sniffing, if publicized, could cause the problem to escalate); (c)impracticability of adequately monitoring sales to youth; and (d) concern that if availability was limited, shoplifting would increase or black markets would be formed.

RESEARCH ISSUES IN INHALANT USE

Measuring any type of substance use almost always poses difficulties, largely because substance use is generally a clandestine behavior. However, measurement of inhalant use has several specific issues that must be considered in order to gain and measure accurately substance use information. Following are a few of the most prominent.

PHRASING OF QUESTIONS

Omnibus Categories. The term "inhalants" encompasses a variety of different substances. By lumping volatile solvents, anesthetics and nitrites under the general category of inhalants, surveys can conceal important differences in prevalence estimates and patterns of use.

Cultural Sensitivity. Personal questions asked of users may need to be phrased in culturally sensitive and relevant ways to assure valid responses. An appraisal of the respondent's cultural connections can pinpoint relevant questions. For many Native Americans and some Hispanic groups there are culturally-defined limits to discussions with non-natives. Psychotherapy is not as effective when administered by non-native therapists, highlighting the need for attention to cultural issues in all aspects of prevention and treatment.

Response Biases

Internal Test Consistency. In personality testing, the same topic can be addressed by differently-phrased questions. Using such techniques, response consistency and truthfulness can be assessed. Studies of inhalant users may need to use this measurement technique, particularly in light of the diverse nature of the user population.

Social Desirability vs. Stigma. Respondents may consider their admission of use of certain inhalants as socially undesirable, shameful, unsophisticated, childish, and stigmatizing. This may compromise the validity of responses. Moreover, the reporting of inhalant abuse data can inadvertently stigmatize the users. For example, Native American youth have been characterized as inhalant abusers, although many of these youth mature out of inhalant use by the time they are seniors; therefore, labeling all such youth as inhalant users is stigmatizing (Beauvais 1990).

The use of broad terms such as Hispanic and African American may be too inclusive to accurately reflect the real subgroups involved; indiscriminate use of these "ethnic glosses" may be both stigmatizing to the groups involved, as well as inadequate representations of the real inhalant user groups (Trimble 1990).

New Drugs and Patterns of Use. One of the side benefits of epidemiological studies is the exploration of new drugs and their patterns of use. In designing new questions, it is worthy to explore whether the wording of questions are sufficiently sensitive to detect new patterns of use, as well as new drugs. Open-ended questionnaire formats can be helpful in this regard.

"ETHNIC GLOSSES" VS. SELF-IDENTIFICATION

More often than not, drug abuse researchers seeking ethnic and cultural explanations select respondents as though they share a common modal understanding of their own ethnicity and nationalistic identification. What we often find are studies focusing on Native Americans, Asian and Pacific Americans, African Americans, Hispanic Americans, Puerto Ricans, and studies involving "Hispanics." For a vast majority of the studies, descriptions of ethnics tend to rely on the use of broad "ethnic glosses," superficial categories which serve only to separate one group from another. Use of such "glosses" gives little or no sense for the richness of cultural variations within these groups, much less the existence of numerous subgroups characterized by distinct lifeways and thoughtways. So how do we assess ethnic-identity and marginality? First, respondents should be given the opportunity to self-identify, and I recommend that ethnic identification be the mainstay of all studies involving ethnic groups. Self-identification by itself is not sufficient since it creates yet another variation of the ethnic gloss. Measures (which means more questionnaire items and therefore will require more time) should tap into the depth and subtle layers of one's ethnicity. As a possibility, I suggest that the measurement domains depicted below serve as a guide:

Natal Measures: Birthplace of self, siblings, natural parents, grandparents and other other relatives
Behavioral Measures: Language usages including settings where used; friendship and acquaintance affiliative patterns; print and electronic media use patterns; participation in cultural and religious activities; music and food preferences; membership in mutual benefit societies and clubs
Subjective Measures: Self-identification of preferred ethnic group; assessment of own acculturative status; real and aspired self-image; value preferences; role models and preferred reference groups; ego-involvement in group; attitudes towards outgroups.

As currently conceived, ethnic-identity consists of the subjective, behavioral and natal domains. Suitable variables are listed beneath each domain that, when aggregated across the measures, would yield a unified index. Respondent indices most likely would vary across a continuum. Such variation permits numerous statistical manipulations not otherwise available to the researcher who uses "ethnic glosses." Moreover, strong, reliable ethnic identification measures would increase external validity offering the field a more valid array of findings.

— *Joseph E. Trimble, Ph.D.*

The "Ever Use" Question. Most surveys ask whether the respondent has ever used a specific drug. Not uncommonly, a new substance is found, briefly used by youth, then abandoned and a new substance is tried. There are many peaks and valleys in inhalant use patterns. One problem is that youth often find it difficult to accurately recall the specifics of their episodic and faddish drug use patterns, particularly if use of some specific substance was limited to a single occasion or occurred in the distant past. There is evidence that many youth grow out of solvent use by late adolescence. Serious concerns can be raised about the accuracy of "ever-used" questions.

Lifetime Prevalence Estimates. Estimates of lifetime prevalence are typically based on data from "ever-use" questions. In general, inhalant use seems to peak at age 13, and declines thereafter (Beauvais 1990); lifetime prevalence of solvent use also declines with age, with older youth reporting lower lifetime prevalence rates than younger children. Such discrepancies in lifetime

prevalence may be attributable to school dropouts; i.e., the study is unable to recapture those children who reported inhalant use at younger ages in follow-up studies because some of them dropped out of school or households (Fredlund 1992; Fredlund et al. 1989; Liu 1996, 1994; Texas Commission on Alcohol and Drug Abuse 1990). Issues of capture-recapture pose significant problems for longitudinal studies in general, and lifetime prevalence estimates in particular.

LOCAL AREA STUDIES

Prevalence rates of inhalant use are not uniform from place to place. Broadly-based regional and national surveys can not capture local differences because locale-specific data are regressed to the grand mean. In attempting to gather data which applies to everyone, it may rather apply to none. This is perhaps more true in inhalant use research than with other drugs, given the cultural and local area characteristics of inhalant use. Localized area studies may be essential for inhalant research.

RESPONDENT POPULATIONS

It can be difficult to get users involved in research efforts. Reliance on treatment populations can inflate (and distort) conclusions about the scope of negative effects of inhalant use; reliance on incarcerated populations poses special problems in respondent truthfulness; household surveys often miss the homeless inhalant abusing population; and school-based surveys miss drop outs, presumably a subgroup at high risk for inhalant abuse. In fact, interpretation of data from school-based longitudinal studies is particularly compromised when drop-out rates are high.

Moreover, random samples may not be truly random, and thus not generally representative of the target population. For example, the bulk of volunteer survey respondents may have been experimental (usually younger) rather than chronic (older) users. Given the age-gradients associated with inhalant use (Beauvais & Oetting 1988), and the observed "maturing out" phenomenon (Kerner 1988; Cohen 1978), careful attention to the age of respondents is essential in evaluating data.

CROSS-SECTIONAL VS. LONGITUDINAL STUDIES

Cross-sectional data provides useful information on how groups differ from each other, especially inhalant users, and particularly how they differ from those who do not use drugs (Oetting 1990). However, ongoing longitudinal data is needed to see changes in patterns and new drugs being used by new types of users, in spite of the high cost of such studies, the heavy time investment in gathering the data, and the difficulty of tracking persons over time. At this point, there do not appear to be any longitudinal studies of inhalant users.

Different methodological approaches (e.g., cross-sectional, longitudinal, ethnographic, and laboratory analog) are differentially well-suited for studies of specific inhalant use variables. Cross-sectional studies are most appropriate for studying the following: school adjustment; family characteristics; deviance by age and by peer group; violence and victims of abuse; and cultural identification factors (Oetting 1990). Longitudinal studies are recommended for exploring family risk variables, school risk factors, and consequences of inhalant use. Ethnographic studies are essential first steps for studies of inhalant-dependent adults, as well as polydrug users who also use inhalants. Laboratory analog studies are best for delineating the social responses of users, describing hostility and anger in users and their families, and for perception studies of users.

POINT ESTIMATES

Surveys. An important survey consideration is when to collect the data. A single point estimate might document the height of the episodic epidemic, and conclude (incorrectly) that there is a major problem. Data

pertinent to the cessation of use may be as informative (particularly for treatment and prevention) as that gathered about the onset or height of the epidemic; new techniques are promising (Hser et al. 1990).

TREATMENT

Treatment Efficacy. In treatment efficacy studies, the user's stage in the drug-dependence cycle may detrimentally affect interpretation of outcome efficacy. Survival analysis, a relatively new statistical technique, offers great promise in resolving these concerns for treatment efficacy studies (Greenhouse et al. 1989; Kazdin & Bass 1989; Anglin & Fisher 1987; Christensen 1987; Fisher & Anglin 1987).

Toxicity Studies. Data needs for research studies on inhalant use are covered in Chapter VI. The time at which measurements of toxic effects are made is important. Whether the user is currently intoxicated, has recently ceased use, is in relapse, and/or has other medical complications can markedly alter the medical evaluation of these individuals.

Treatment Stages. Treatment would be enhanced by knowing when patients are sufficiently detoxed to engage in therapeutic activities. Furthermore, the development of assessment protocols that would track neurological and psychological gains over the course of treatment would be useful.

SUMMARY OF INHALANT ISSUES

There are many difficulties in studying inhalant use and abuse. This document has summarized many of the vexing issues confronting epidemiologic, toxicologic, treatment, and preventive efforts. There is a general consensus that a broad-based effort encompassing multiple disciplines and social institutions is needed. The problem involves both people and products, but the primary avenue for remediation of the problem involves working with the needs of the people who are at risk. Although improvements can and should be made in reducing the toxicity and availability of inhalants, it is difficult to imagine an environment free of available inhalants in today's society.

The challenge is prevention: to deter experimentation and to interrupt patterns of involved use. Youth who become involved with inhalants tend to have multiple problems and require targeted, coordinated services, designed for their specific problems and needs, in a culturally appropriate context in order to be effective. This is a challenge we cannot afford to ignore. It is a challenge to save the future for these youth and for the human potential that they represent.

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APPENDIX A

CHARACTERISTICS OF INHALANT USERS

CHARACTERISTICS OF INHALANT USERS - (A)

AGE OF ONSET

Often first substance used before marijuana & cocaine	Liu & Maxwell 1995
Chronic use appears in young & late adolescence	Beauvais & Oetting 1988; May and Del Vecchio (in press); Compton et al. 1994
Experimental use onset in late childhood & early adolescence, use patterns are short-lived, with cessation for most in late adolescence	WHO 1986; Beauvais & Oetting 1988

FAST AND MULTIPLE INTOXICATIONS

Users can get high several times over a short period because inhalants are short-acting with a rapid onset. Attractive to children who don't like to delay gratification.	Smart & Adlaf 1989; WHO 1986

POOR SCHOOL ATTENDANCE

Drop-outs, absenteeism, suspension, expulsion	Jacobs & Ghodse 1988; Uchtenhagen 1986; Reed & May 1984; Matthews & Korman 1981; Schottstaedt & Bjork 1977; Annis & Watson 1975; Galli 1974; Winburn & Hays 1974; Compton et al. 1994; Liu 1994, 1996

DELINQUENCY

Particularly theft and burglary	Smart 1983; Swerhun & LeBreton 1983; Stybel et al. 1976; Reed and May, 1984
Inhalant users are more disruptive, deviant or delinquent than other drug users	DeBarona & Simpson 1984

MINORITY GROUP MEMBERSHIP

American and Canadian Native American Indians	Smart 1986; Streicher et al. 1981; Barnes 1979; Padilla et al. 1979; Barnes 1980; Fredlund 1994
Poor Hispanics	HHANES 1987; Press & Done 1967
Poor African Americans in southern United States	Press & Done 1967

GENDER

Experimental use equally common in males, females	Beauvais et al. 1985; Korman et al. 1980
Chronic use most common in males	Fredlund et al. 1989; Frank et al. 1988; HHANES 1987; Uchtenhagen 1986; Korman 1977; Cohen 1973
Adult female inmates more likely to report use of nitrites; males used spray paint	Farabee 1994, 1995
Morbidity and mortality more common among chronic male users	Beauvais et al. 1985; Korman et al. 1980
Some male homosexuals (limited to nitrites)	Westermeyer 1986; Schwartz 1989

HIGH EXPOSURE OCCUPATIONAL SETTINGS	
Adults in certain high exposure occupational settings (e.g., painters & air conditioning technicians)	Westermeyer 1986; Parker 1989; Sharp and Rosenberg (in press); Maxwell 1994
HIGH EXPOSURE PROFESSIONS	
Adult medical workers (e.g., anesthesiologists, dentists)	Perez de Francisco 1975
USE OF MULTIPLE INHALANTS	
Exposure to solvent mixtures either in occupational or abuse setting is far more common than exposure to a single solvent	Rosenberg & Sharp 1992; Liu & Maxwell 1995
USE OF OTHER DRUGS	Edeh 1989; Carlini-Cotrim & Carlini 1988; Mata & Andrew 1988; Oetting et al. 1988; DeBarona & Simpson 1984; Smart 1983; Swerhun & LeBreton 1983; Barnes 1979; Stybel et al. 1976; Ellison 1964; Sokol & Robinson 1963; WHO 1986; Rosenberg & Sharp 1992; Compton et al. 1994; Schurtz, Chilcont & Anthony 1994; Dinwiddie et al. 1991
MULTIPLE PERSONAL AND SOCIAL PROBLEMS	Beauvais et al. 1985; Cohen 1978; Medina-Mora et al. 1978; Oetting & Webb, 1992
POOR ADJUSTMENT TO WORK ENVIRONMENTS	Korman et al. 1980; Berriel-Gonzales et. al. 1978; Comstock 1978; Medina-Mora et al. 1978
MULTIPROBLEM AND DISRUPTED FAMILIES	Carlini-Cotrim & Carlini 1988; Jacobs & Ghodse 1988; DeBarona & Simpson 1984; Reed & May 1984; Sourindhrin & Baird 1984; Gilbert 1983; Korman et al. 1980; Albaugh & Albaugh 1979; Barnes 1979; Crites & Schuckit 1979; Berriel-Gonzales et al. 1978; Comstock 1978; Guitierrez et al. 1978; Leal et al. 1978; Schottstaedt & Bjork 1977; Nurcombe et al. 1970; Massengale et al. 1963; Zuv & Yule 1990; Liu & Maxwell 1995; Fredlund 1994
PARENTAL ALCOHOL/DRUG ABUSE	TCADA 1990; Carlini-Cotrim & Carlini 1988; Bachrach & Sandler 1985; Gilbert 1983; Barnes 1980; Barnes 1979; Babst et al. 1978; Berriel-Gonzales et al. 1978; Guitierrez et al. 1978; Stybel et al. 1976; Press & Done 1967; Smith, Joe & Simpson 1991

CHARACTERISTICS OF INHALANT USERS - (C)

LOW SOCIOECONOMIC CONDITIONS	Carlini-Cotrim & Carlini 1988; Altenkirch & Kindermann 1986; Korman et al. 1980; Berriel-Gonzales et al. 1978; Guitierrez et al. 1978; Ellison 1964; Sokol & Robinson 1963; Oetting & Webb 1992; Fredlund 1994
Impoverished, marginal or ghetto situations	Smart 1986; Uchtenhagen 1986; WHO 1986; Velez 1982; Streicher & Gabow 1981; Padilla et al. 1979; Berriel-Gonzales et al. 1978
WEAKENED PARENTAL INFLUENCE	
Some parents do not discourage their child's use of inhalants	WHO 1986; Frank et al. 1988 Leal et al. 1978; Boeckx et al. 1977
Some parents do discourage their child's use of inhalants	Bachrach & Sandler 1985; Beauvais et al. 1985; DeBarona & Simpson 1984
Some parents have low sanctions against inhalant use by peers of their children	Bachrach & Sandler 1985; Beauvais et al. 1985
POOR SCHOOL PERFORMANCE AND ADJUSTMENT	Frank et al. 1988; Barnes 1979; Medina-Mora et al. 1978; Nurcombe et al. 1970
Attention deficit; poor short term memory; low abstraction and judgement scores	Fornazzari et al. 1983; Korman et al. 1981
Lower grades	Bachrach & Sandler 1985; DeBarona & Simpson 1984; Matthews & Korman 1981; Korman et al. 1980; Crites & Schuckit 1979; Stephens et al. 1978; Schottstaedt & Bjork 1977; Kandel 1975; Galli 1974; Barker & Adams 1973; Press & Done 1967; Ackerly & Gibson 1964; Massengale et al. 1963; Liu & Maxwell 1995; Liu 1994
NEUROLOGICAL AND NEUROPSYCHOLOGICAL DEFICITS	Fornazzari et al. 1983; Korman et al. 1981; Byrne et al. 1991; Chadwick & Anderson 1989; Sharp & Rosenberg (in press); Rosenberg 1988
EMOTIONAL PROBLEMS	
More emotional problems than other drug users or nondrug users (especially anxiety, depression, anger)	Oetting et al. 1988; Fejer & Smart 1973; Weise et al. 1973; Nurcombe et al. 1970

PSYCHOPATHOLOGY	
Users seeking treatment have high rates of psychopathology, especially conduct disorders and personality disorders	Skuse & Burrell 1982; Korman et al. 1980; Comstock 1978; Compton et al. 1994; Watson 1986
More psychopathology in those who use when alone	Guitierrez et al. 1978
Antisocial personality	Dinwiddie et al. 1987; Crites & Schuckit 1979; Swadi 1996; Dinwiddie et al. 1991; Fredlund 1995
Depressive disorder	Guitierrez et al. 1978; Zur & Yule 1990; Swadi 1996
Psychosis	Byrne et al. 1991
WEAK OR NEGATIVE "FUTURE ORIENTATIONS"	
Users have dismal or no future orientations, uncertain whether or not the future is worth fighting for	Giovacchini 1992; Fredlund 1994
LOW SELF-ESTEEM	WHO 1986; Wingert & Fifield 1985; Annis et al. 1971
HIGH ADOLESCENT REBELLION	Duncan 1986; Gregory 1986
STRONG PEER DRUG INFLUENCE	Liu & Maxwell 1995; Jacobs & Ghodse 1988; Bachrach & Sandler 1985; Barnes 1979; Cohen 1978; Schottstaedt & Bjork 1977; Stephens et al. 1978; Stybel et al. 1976; Joe Barret & Simpson 1991; Oetting & Webb 1992
Peers have high inhalant and drug use	Mata & Andrew 1988; Oetting et al. 1988; Bachrach & Sandler 1985; Stephens et al. 1978
Peers have high deviance behaviors	DeBarona & Simpson 1984; Oetting & Webb 1992
Peer Cluster Theory	Oetting et al. 1988
SPECIAL SETTINGS	
Prisons	Westermeyer 1986
Boarding schools	Guitierrez et al. 1978

CHARACTERISTICS OF INHALANT USERS - (E)	
ACCULTURATION STRESS	Barratt et al. 1990; Gilbert 1983; Barnes 1979; Nurcombe et al. 1970
CRIMINAL JUSTICE SYSTEM INVOLVEMENT	Farabee 1995, 1994 (male & female); Fredlund et al.1990; Jacobs & Ghodse 1988; Altenkirch & Kindermann 1986; Bachrach & Sandler 1985; DeBarona & Simpson 1984; Reed & May 1984; Korman et al. 1980; Crites & Schuckit 1979
More family members in prison	Jacobs & Ghodse 1988; Berriel-Gonzales et al. 1978

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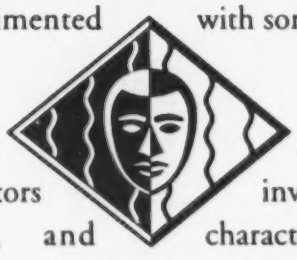
BRINGING TEXAS A NEW VIEW OF HUMAN POTENTIAL

To say that inhalant use is an epidemic is an understatement.

Inhalants are among the most likely drugs to be used by adolescents, behind only tobacco, alcohol, and sometimes marijuana. In Texas, almost one-quarter of 12 to 13-year-olds have already experimented with some type of inhalant.



Inhalants present a complex drug problem due to factors involving availability, effects of use, and characteristics of the users themselves. *Understanding Inhalant Users* provides an overall picture of inhalants and those who abuse them and is a valuable resource for parents, educators, clinicians, and anyone interested in really understanding the problems underlying inhalant abuse. *Understanding Inhalant Users* summarizes and interprets a variety of inhalant-related findings to provide a clear, research-based understanding of this urgent problem.

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